DOCUMENT RESUME

ED 472 943 SE 067 103

AUTHOR	Watson, Anne; Morgan, Candia
TITLE	Teacher-Assessment and Equity.
PUB DATE	2000-00-00
NOTE	11p.; Paper presented at the International Mathematics Education and Society Conference (2nd, Montechoro, Portugal, March 26-31, 2000).
PUB TYPE	Reports - Research (143)
EDRS PRICE	EDRS Price MF01/PC01 Plus Postage.
DESCRIPTORS	*Evaluation; Curriculum Development; Elementary Secondary Education; *Equal Education; Foreign Countries; *Mathematics Education; Teacher Influence; Teacher Role
IDENTIFIERS	United Kingdom

ABSTRACT

This paper presents a critique of teachers' assessment practices from a social justice standpoint. It is based on two studies of different aspects of the established system of teacher assessment in the United Kingdom. Each study found that teachers' own perspectives, resources, and interpretations led to the construction of views of students' mathematics which differed from those constructed by other teachers or researchers. It is concluded that professional critiques of assessment decisions made about individuals need to be developed and raises further research questions about equity in assessment practice. (Author/KHR)

Reproductions supplied by EDRS are the best that can be made
from the original document.

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY

A. Watson

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

1

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

TEACHER-ASSESSMENT AND EQUITY

Anne Watson, University of Oxford
Candia Morgan, Institute of Education, University of London

ED 472 943

This paper presents a critique of teachers' assessment practices from a social justice standpoint. It is based on two studies of different aspects of the established system of teacher assessment in the UK. Each study found that teachers' own perspectives, resources and interpretations led to the construction of views of students' mathematics which differed from those constructed by other teachers or researchers. The authors conclude that professional critique of assessment decisions made about individuals needs to be developed, and raise further research questions about equity in assessment practices.

Recent research and curriculum development related to assessment in mathematics education has been associated with changes in conceptions of the nature of mathematical learning. There have been some powerful critiques of the poverty of the information provided by some traditional methods of assessment and of the inequity inherent in them (e.g., Burton, 1994). Assessment methods associated with "reform" curricula have also begun to be critiqued from an equity perspective (e.g., Cooper & Dunne, 1998). In rejecting crude positivism, however, most reformers and researchers have still made the assumption that, with "improved" methods, it is possible to achieve valid insight into students' thinking. We wish to problematise this assumption.

In a number of countries, the wish to broaden the repertoire of strategies for assessing students in mathematics has led to an increase in the responsibility devolved to teachers for assessing their own students. Among the potential problems, Clarke (1996) identifies teachers' lack of expertise in "devising, employing and interpreting assessment tasks" (p. 333). This formulation assumes that it is possible to have "expertise" in interpreting students' responses and that teachers can be supported in gaining this. We shall argue, both theoretically and through our empirical investigations of the practices of teachers engaged in such interpretation, that this is not a simple issue. The two independently conceived but complementary research programmes that we shall describe (Morgan, 1998; Watson, 1997; 1998) both address concerns with the nature of teachers' "expertise" as assessors.

Assessment is contextualised and interpretative

Every act of assessment takes place within a specific context, consisting not only of the current circumstances but also of the resources brought to bear by the assessor (including personal knowledge of mathematics and of the curriculum, experience and expectations of a particular child and of children in general, beliefs about assessment, experience of the classroom, etc.). These "reader resources" (Fairclough, 1989) arise both from the assessor's personal, social and cultural history and from their current positioning within a particular discourse. The professional enculturation of teachers seems likely to ensure a certain degree of common resource, as may be seen in the success of training programmes and joint moderation meetings in achieving consensus

SE067403

BEST COPY AVAILABLE

about ranks, levels and grades in relation to individual pieces of work and portfolios (see, for example, Wiliam, 1994). However, teacher-assessors will also make use of more individual resources, including their past and present relationships with individual students or with groups of students and the extent of their authority and autonomy as professionals. A range of positions are available to teachers in relation to their students, other teachers and external authorities (Morgan, 1994). Different positionings are likely to give rise to the use of different sets of resources and hence to different actions and judgements by different teachers or by a single teacher at different times in different circumstances (cf. Evans & Tsatsaroni, 1998; Walkerdine, 1988) .

The two studies of teacher-assessment that we discuss below are located within interpretative paradigms. In both studies attention was focused on possible ways of interpreting texts, where "text" is taken to encompass physical actions, facial or body language as well as spoken or written language. The teacher "reads" any text produced by a student in an interpretative and contextualised way, constructing meaning in terms of the student's mathematical attainment. A new orthodoxy of mathematical activity and interactive classroom practice, rooted in various versions of constructivism, is fairly well-established in mathematics education, based on recognition of the interpretative and contingent nature of students' construction of knowledge. Less consideration has been given to how teachers base pedagogic decisions on their constructions of individual students' mathematics. Though Simon (1995), for example, writes that "the teacher can compare his understanding of a particular concept to his construction of the students' understandings, not to the students' 'actual' understandings" (p.135), the cumulative effect of such interpretations is not discussed, and any doubts about the validity of summative statements of student achievement tend to be expressed in terms of the quality of the sampling of student behaviour (due to situatedness, temporal specificity, assessment style etc.) rather than in terms of its interpretation.

The impressions and expectations of their students that teachers develop through their readings of the evidence available to them are incorporated into the curriculum and into future interactions with the student. Hence expectations tend, unsurprisingly, to be fulfilled (Nash, 1976). Early impressions are therefore crucially important and may have such a strong effect that subsequent events are noticed and interpreted only insofar as they support the original impression (Nisbett and Ross, 1980). Moreover, teachers' expectations about students' mathematical learning may not be based on mathematical evidence, but on the evidence of other behaviour, social skills, and social class background (McIntyre et al, 1966; Walkerdine, 1984). What appears salient to one teacher may not to another; this is a particular issue within mathematics with its wide range of possible modes of communication.

The research studies

The two studies we will discuss originated within the assessment system in UK state schools, where teachers' assessments of students' mathematics have been a statutory part of national assessment procedures for over ten years. All teachers have been trained

to incorporate assessment into their teaching, and to use assessment criteria. While the particular national context necessarily affects the detail of the teacher-assessor practices that we will describe, our analyses illuminate broader issues which have to be seen as features of an established system.

Study A: Teacher's constructions of views of students' mathematics

The initial aim of study A was to develop a description of ways in which teachers interpret and accumulate their experience of students in mathematics classrooms, not only during formal assessment situations but also during normal day-to-day activity (Watson, 1995; 1999). Interviews with teachers revealed a number of problematic aspects of practice. When asked about individual students, teachers talked more of their learning behaviour in general than specific achievements. For example, it was common to say that students who were regarded as strong mathematicians were "well-organised and self-motivated" or "quick" rather than to describe particular mathematical features of their work. Although teachers thought it very important to take into account students' oral work, they tended to do this unsystematically. A combination of records of written work and personal recollection formed the basis for most teachers' assessments. Teachers spoke of "getting to know" students as a frame for interpreting their work, rather than as an outcome of informal assessment. Summative assessment was done partly by personal recollection – some teachers, knowing the flaws of testing, regarded this as much fairer than testing.

These issues were explored further in a study of two teachers "getting to know" new classes (Watson, 1997). The researcher observed ten students in one lesson a week with each teacher during the first term with the new class. All public verbal utterances and some one-to-one interactions by the target students were noted, all written work produced by each student during the term was scrutinised, behaviour and actions were observed and noted using a combination of systematic observation punctuated with records of complete incidents, as interpreted by the researcher. Considerably more observed information about behaviour and actions of the target students was available to the researcher than to the teacher, though they had similar oral data and the same written data; the researcher also had more time to consider the data. Both the researcher and the teacher formed views about the target students' mathematics and discussed them regularly with each other, but the differences in the data to which they had access contributed to substantially different interpretations. The following example illustrates typical differences.

Sandra (aged 11) took part enthusiastically in the routine start of each lesson when the class marked their own answers to mental arithmetic questions done at home. She sometimes called out answers and often put her hand up energetically, waving it around to attract attention. Nearly all her enthusiastic contributions to class arose from work done at home or, very occasionally, from discussions the teacher had with her. When her answers were wrong Sandra made comments like "but my father said ...." It was as if she knew that to get approval from the teacher you had to show right answers

publicly, and she was skilled in getting those right answers not from her own head but from her father or from the teacher. Other evidence to support an interpretation that Sandra was weak in number work was her use of fingers, particularly for subtraction, in situations where a competent arithmetician would have known number bonds or have developed some patterning strategies.

The teacher, while being aware that Sandra sometimes altered answers as she marked them, was not aware of the extent of the alterations and had a view that Sandra was mainly good at mental arithmetic, changing answers in order to boost her confidence. The teacher's estimation of her arithmetic, initially low as a result of a test, had risen to a relatively high level as a result of her oral contributions to class. The researcher's estimation was that she lacked skills, lacked useful internalisation of arithmetical facts, and had previously relied on performance of algorithms which she failed to remember. It was as if the teacher had a neutral view of her until something outstanding happened, in this case her enthusiastic contribution to homework feedback sessions. Once there had been an event which allowed him to differentiate her mathematics from that of other students, the view he formed remained strongly with him so that subsequent events were interpreted in that light. Hence her alteration of answers became under-represented in his picture of her and the pattern of her responses was not obvious to him.

In contrast, the teacher felt that Sandra was relatively weak in her ability to think mathematically while using and applying mathematics or when tackling new ideas. However, several instances of mathematical thinking were inferred by the researcher from Sandra's verbal comments and from her actions. In these instances she appeared able to devise strategies, adapt strategies which have been effective in the past, describe patterns and make conjectures resulting from patterns.

Relative to the researcher, therefore, the teacher *appeared* to overestimate skills in the area of mathematics in which Sandra wanted him to be interested, and to underestimate her skills of reasoning. The teacher, seeing her work always in the context of what the rest of the class did and what his own expectations were, makes a judgement which is *comparative* to what she has done before and to the rest of the class. But "what she has done before" includes creating an impression in his mind, therefore judgements are relative to the picture already formed. Of course, the researcher was able to see a pattern to Sandra's oral contributions that was not visible to the teacher. It was the pattern and circumstances of the contributions, rather than their quantity or nature, which indicated the contrast between her arithmetical abilities and her desire to be good with calculations. The teacher has seen this analysis and accepts it as a description of aspects of Sandra's work and the problems of informal judgement of which he was not, *and could not* be aware. The competing demands on the teacher's attention in a classroom make detailed observation impossible.

Analysis of data about the ten students in this study led to the identification of a number of issues (see Watson (1997) for a fuller discussion):

- teachers may see only part of the whole story;
- teachers may see, or fail to see, patterns in responses and behaviour;
- some behaviour may be over- or under-represented in the teacher's mental picture;
- teachers may be strongly influenced by students' strong or weak social skills;
- teachers interpret work in the light of existing impressions;
- time constraints on the teacher prevent full exploration of mathematics;
- perceptions of external purposes affect assessment;
- teachers are unable to see and use all the details which occur in classrooms.

In no sense are we suggesting that there is a true view to be achieved, nor that the researcher is correct and the teacher wrong. On the contrary, the study suggests that teachers' informal assessments, made in classroom contexts, are *inevitably* influenced by a variety of unavoidable factors which may have little to do with mathematical achievement. In the UK system, these informal assessments contribute to formal, summative, high-stakes assessments as the teacher brings her perceptions of the student to bear on subsequent interpretations of mathematical performance. It is of concern that this takes place within a system in which teachers have been trained to use detailed, tested, criteria, and where assessments contribute to high-stakes decisions.

Study B: Teacher assessment of written mathematics in a high-stakes context

The second study was set in the context of the high-stakes GCSE examination for students aged 16+ in England and Wales. The coursework component of this examination, which is assessed by teachers, most commonly takes the form of reports of one or more extended investigative tasks. These reports are intended to include evidence of the mathematical processes that students have gone through (for example: systematising, observing, conjecturing, generalising, justifying) as well as the results of their investigation. The original concern of this study was to investigate the forms of writing that students produced in their coursework and to consider the match or mismatch between student writing and the forms of mathematical writing valued by teacher assessors (Morgan, 1998). Analysis of interviews with 11 experienced teachers reading and evaluating students' coursework texts explored the teachers' assessment practices, the features of the texts that the teachers attended to, and the values that came into play as they formed judgements about the texts and about the student-writers. The issue emerging from the results of these analyses that we wish to consider here is the diversity that was discovered, both in the ways different teachers approached the task of reading and assessing student texts and in the meanings and evaluations they constructed from the same texts (Morgan, 1996; 1998).

All the teachers had been trained in the use of common sets of criteria, were experienced in applying these criteria to their own students' work, and had participated in moderation processes. Nevertheless, their relationships to the criteria and their methods of approaching the task of applying them were in some cases very different. The following example illustrates the ways in which teachers reading with different resources can arrive at very different judgements about the same student.

One student, Steven, had written a report on his work on a task called 'Topples' that involved investigating piles built up of rods of increasing lengths, seeking a relationship between the length of the rod at the bottom of the pile and the length of the rod that would first make the pile topple over. Steven found a formula expressing this relationship, $(A + A) + \left(\frac{A}{2}\right) = b$, and showed that he could use it to find the length of the 'topple rod' for piles starting with rods longer than those he had available to build with. He then presented an alternative method for finding results for piles starting with very long rods by scaling up his results for piles starting with short rods:

> *An alternative way to do this would be to take the result of a pile starting at 10 and multiply it by 10*
>
> $$(10 + 10) = 20 \quad \left(\frac{10}{2}\right) = 5$$
>
> $$20 + 5 = 25$$
>
> $$25 \times 10 = 250$$

No derivation or further justification of this method was provided in the text. In order to evaluate Steven's work, each teacher-reader constructed his or her own understanding, not only of the method itself but also of the means by which Steven might have derived it and of Steven's level of mathematical achievement. The following extracts from interviews with two teachers reading this section of Steven's work illustrate how different these understandings can be.

> Teacher 1: Charles *Um ok so I mean he's found the rule and he's quite successfully used it from what I can see to make predictions about what's going to happen for things that he obviously can't set up. So that shows that he understands the formula which he's come up with quite well, I think. There's also found some sort of linearity in the results whereby he can just multiply up numbers which again shows quite a good understanding of the problem I think.*

Charles recognises the mathematical validity of the alternative method, relating it to the linearity of the relationship between the variables. He takes this as a sign that the student has "come up with" the formula as a result of understanding the linearity of the situation. This results in a positive evaluation of Steven's mathematical understanding.

> Teacher 2: Grant *It's interesting that the next part works, I don't know if it works for everything or it just works for this but he's spotted it and again he hasn't really looked into it any further. He's done it for one case but whether it would work for any other case is er I don't know, he hasn't looked into it [...] And it's just a knowledge of number that's got him there I think intuition whatever. He may have guessed at a few and found one that works for it.*

Grant appears less confident with the mathematical validity of the alternative formula, expressing some uncertainty about whether the method would work in general. Perhaps because of this uncertainty, his narrative explaining how Steven might have arrived at the method devalues the student's achievement, suggesting that the processes involved were not really mathematical: "spotting" the method, not looking into it properly, guessing, using "just a knowledge of number" or "intuition".

In this case, the teachers' different interpretations of Steven's level of understanding and different hypotheses about the methods he might have used to achieve his results seem to be connected to their personal mathematical resources. It is Charles, expressing a clear understanding of the relationship of the alternative method to the linearity of the situation, who makes the most positive evaluation of Steven's understanding, while Grant , apparently uncertain of the general validity of the method, constructs a picture of the student working in relatively unstructured or experimental ways. Other differences in interpretation and evaluation of Steven's results and his means of achieving them were also evident in other teachers' readings of his text.

In order to make sense of a text and to use it to evaluate the student-writer's achievement, each teacher must compose an explanatory narrative, drawing on the resources available to them. These resources include common expectations of the general nature of investigation and investigative reports. Where students had produced 'standard' work and expressed it using the conventions of the investigation report genre it was found that teachers' evaluations coincided closely. However, if a student text diverges from the 'usual' to the extent that it is not covered by the established common expectations, each teacher must resort to their more personal resources, thus creating the possibility of divergence in the narratives they compose. Major differences between teachers in their interpretations and evaluations of students' texts occurred primarily where the student's text diverged from the 'norm' in some way – either in its mathematical content or in the form in which it was expressed.

Other ways in which teachers' interpretations and approaches to evaluation were found to differ included:

- different hypotheses about work that the student might have done in the classroom that was not indicated in the written text – and different attitudes towards valuing such unrecorded achievement;
- different judgements about factual aspects of the text, for example, whether the wording of the problem given by the student had been copied from the original source or had been paraphrased in the student's own words;
- different approaches to the task of assessing a piece of student work: some teachers appeared to focus on building up an overall picture of the characteristics of the student, some were interested in making mathematical sense of what the student had done, while others focussed solely on finding evidence in the text to meet specific criteria;

- different ways of resolving tensions between the teachers' own value systems and their perceptions of the demands of externally imposed sets of assessment criteria.

Conclusions

The two studies illustrate the variations that are possible in judgements teachers make about students' mathematical achievements and suggest some of the sources of these variations. The first study suggests that teachers form views of students' mathematical strengths and weaknesses based on information which is inevitably partial, due to the impossibility of seeing and hearing everything, the need to stress some aspects of a student's performance and decide which others are unimportant. The second study shows that judgements about written work in mathematics are intimately connected with the values and experiences that teachers bring to their interpretations of student text. It seems likely that such values and previous experiences are also significant in influencing the aspects of student behaviour that teachers notice and attach importance to in the classroom. While the evidence teachers are able to attend to in the classroom is inevitably partial and will vary between different observers, even when exactly the same evidence is available to all observers (as it is in the case of written texts) the two studies show that different teachers can interpret the same or similar student texts of all kinds in very different ways, attending to different salient features and placing different values on similar features. These differences can occur both in informal classroom assessment and in formal high-stakes situations.

In both studies the teachers were experienced and had been trained in assessment methods. They were also aware that they were involved in research about assessment. They may thus be assumed to have been making judgements in the most professional ways they knew about. Differences are unlikely, therefore, to be attributable to a lack of skill or a lack of professionalism. In both situations the judgements could influence what happens next in the student's mathematical career. Judgements made in the everyday classroom influence the teacher's future interactions with the student and the mathematical teaching provided, while judgements in more formally summative contexts have obvious 'high-stakes' consequences for progression to further education and employment opportunities. Yet, in both situations the positions and priorities, values and experience of the teacher influence the judgement.

While it may be possible to resolve such differences in summative assessments where there is time available and teachers can meet and discuss decisions (Clarke, 1996; NCTM, 1995; SEAC, 1991), we would argue that, because of the interpretative nature of any act of assessment, it is not possible to avoid differences altogether. This raises important issues for equity in education both in summative and formative situations. In particular, those students who do not share the social, cultural and linguistic background of the teacher-assessor are less likely to have access to the resources that would enable them to produce texts that will have the features that the teacher will attend to and value highly. Moreover, the consequences of even informal teacher judgements are not merely fleeting but have lasting influence on the educational opportunities available to students.

We are not suggesting that teachers should not make judgements; people have to make subjective judgements about others in order to communicate. Moreover, we are not arguing that teachers are "bad" at assessing and need to be trained in "correct" methods. Rather we would argue for further professionalisation of the ways teachers read and evaluate students' mathematical texts, and the ways they make use of their informal evaluations. This might involve the development of self-critical approaches to making assessments about others, including awareness of the relative, partial, and interpretative nature of assessments, of the prejudices which may influence them and of the ways in which assessment can deny students access to equal opportunities. A critical professional environment in which colleagues are expected to question and justify decisions could support such development.

Further questions

In considering the implications for future research related to teacher assessment in mathematics education, we are concerned both with the quality and nature of the judgements made by teachers and with the issues of equity raised by questions about students' access to the means of expression that are likely to lead to high evaluation of their mathematical competence. Questions that need to be addressed include:

- What are the characteristics of student behaviour that will lead to a student being seen as a competent mathematician, and that will lead to high evaluations?
- To what extent are students belonging to various social and cultural groups aware of their teachers' values and expectations and able to demonstrate them?
- To what extent are teachers, teacher educators and assessment designers aware of the ways in which assessments may be influenced by various teachers' values and expectations?
- How can teachers raise students' awareness of their assessors' values and expectations and enable students to behave in (mathematical, linguistic and social) ways that will lead to high evaluations?
- Do the differences between and within teachers' judgements act structurally to disadvantage certain social groups? How do any such inequities relate to those known to be inherent in formal written tests?

References

Burton, L. (Ed.). (1994). *Who Counts? Assessing Mathematics in Europe*. Stoke-on-Trent: Trentham Books.

Clarke, D. (1996). Assessment. In A. J. Bishop, K. Clements, C. Keitel, J. Kilpatrick, & C. Laborde (Eds.), *International Handbook of Mathematics Education* (Vol. 1). Dordrecht: Kluwer, 327-370.

Cooper, B., & Dunne, M. (1998). Social class, gender, equity and National Curriculum tests in mathematics. In P. Gates (Ed.), *Proceedings of the First International*

Mathematics Education and Society Conference. Nottingham: Centre for the Study of Mathematics Education, Nottingham University, 132-147.

Evans, J., & Tsatsaroni, A. (1998). You are as you read: The role of texts in the production of subjectivity. In P. Gates (Ed.), *Proceedings of the First International Mathematics Education and Society Conference* . Nottingham: Centre for the Study of Mathematics Education, University of Nottingham, 168-179.

Fairclough, N. (1989). *Language and Power*. Harlow: Longman.

McIntyre, D., Morrison, A. & Sutherland, J. (1966). Social and educational variables relating to teachers' assessments of primary pupils. *British Journal of Educational Psychology*, Vol. 36, 272-279.

Morgan, C. (1994). Teachers assessing investigations: The role of algebra. In J. P. da-Ponte & J. F. Matos (Eds.), *Proceedings of the 18th Conference of the International Group for the Psychology of Mathematics Education* (Vol. 3). Lisbon, 295-302.

Morgan, C. (1996). Teacher as examiner: The case of mathematics coursework. *Assessment in Education 3*(3), 353-375

Morgan, C. (1998). *Writing Mathematically: The Discourse of Investigation*. London: Falmer.

Nash, R.(1976). *Teacher Expectations and Pupil Learning*. London: RKP.

NCTM. (1995). *Assessment Standards for School Mathematics*. Reston VA: National Council of Teachers of Mathematics.

Nisbett, R. & Ross, L. (1980). *Human Inference: Strategies and Shortcomings of Social Judgement*. Englewood Cliffs: Prentice-Hall.

SEAC (1991). *NC Assessment: a moderator's handbook 1991/2, Key Stage 1*. London: HMSO.

Simon, M. (1995). Reconstructing mathematics pedagogy from a constructivist perspective. *Journal for Research in Mathematics Education, 26 (2),* 114-145.

Walkerdine, V. (1984). Developmental psychology and the child-centred pedagogy: the insertion of Piaget into early education. In J. Henriques (Ed.) (1984). *Changing the Subject: Psychology, Social Regulation and Subjectivity*. London: Methuen.

Walkerdine, V. (1988). *The Mastery of Reason: Cognitive development and the production of rationality*. London: Routledge.

Watson, A. (1997). Coming to know pupils: A study of informal teacher assessment of mathematics. In E. Pehkonen (Ed.), *Proceedings of the 21st Conference of the International Group for the Psychology of Mathematics Education* (Vol. 4). Lahti: University of Helsinki, 270-277.

Watson, A. (1999). Paradigmatic conflicts in informal mathematics assessment as sources of social inequity. *Educational Review, 51 (2)* 105-115.

Wiliam, D. (1994). Assessing authentic tasks: Alternatives to mark-schemes. *Nordic Studies in Mathematics Education, 2*(1), 48-68.

SE067103

U.S. Department of Education
Office of Educational Research and Improvement (OERI)
National Library of Education (NLE)
Educational Resources Information Center (ERIC)

REPRODUCTION RELEASE

(Specific Document)

I. DOCUMENT IDENTIFICATION:

Title: TEACHER - ASSESSMENT & EQUITY	
Author(s): ANNE WATSON (UNIVERSITY OF OXFORD) & CANDIA MORGAN (INSTITUTE OF EDUCATION, UNIVERSITY OF LONDON)	
Corporate Source: PROCEEDINGS OF 2nd INTERNATIONAL MATHEMATICS EDUCATION AND SOCIETY CONFERENCE: UNIVERSIDADE DE LISBOA, PORTUGAL	Publication Date: 2000

II. REPRODUCTION RELEASE:

In order to disseminate as widely as possible timely and significant materials of interest to the educational community, documents announced in the monthly abstract journal of the ERIC system, *Resources in Education* (RIE), are usually made available to users in microfiche, reproduced paper copy, and electronic media, and sold through the ERIC Document Reproduction Service (EDRS). Credit is given to the source of each document, and, if reproduction release is granted, one of the following notices is affixed to the document.

If permission is granted to reproduce and disseminate the identified document, please CHECK ONE of the following three options and sign at the bottom of the page.

The sample sticker shown below will be affixed to all Level 1 documents	The sample sticker shown below will be affixed to all Level 2A documents	The sample sticker shown below will be affixed to all Level 2B documents
PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY Sample TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) 1	PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE, AND IN ELECTRONIC MEDIA FOR ERIC COLLECTION SUBSCRIBERS ONLY, HAS BEEN GRANTED BY Sample TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) 2A	PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY Sample TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) 2B
Level 1	**Level 2A**	**Level 2B**
Check here for Level 1 release, permitting reproduction and dissemination in microfiche or other ERIC archival media (e.g., electronic) and paper copy. ✓	Check here for Level 2A release, permitting reproduction and dissemination in microfiche and in electronic media for ERIC archival collection subscribers only	Check here for Level 2B release, permitting reproduction and dissemination in microfiche only

Documents will be processed as indicated provided reproduction quality permits.
If permission to reproduce is granted, but no box is checked, documents will be processed at Level 1.

I hereby grant to the Educational Resources Information Center (ERIC) nonexclusive permission to reproduce and disseminate this document as indicated above. Reproduction from the ERIC microfiche or electronic media by persons other than ERIC employees and its system contractors requires permission from the copyright holder. Exception is made for non-profit reproduction by libraries and other service agencies to satisfy information needs of educators in response to discrete inquiries.

Signature: Anne Watson	Printed Name/Position/Title: DR ANNE WATSON	
Organization/Address: UNIVERSITY OF OXFORD	Telephone: 44 1865 274052	FAX: 274027
	E-Mail Address:	Date: 14/1/03

III. DOCUMENT AVAILABILITY INFORMATION (FROM NON-ERIC SOURCE):

If permission to reproduce is not granted to ERIC, or, if you wish ERIC to cite the availability of the document from another source, please provide the following information regarding the availability of the document. (ERIC will not announce a document unless it is publicly available, and a dependable source can be specified. Contributors should also be aware that ERIC selection criteria are significantly more stringent for documents that cannot be made available through EDRS.)

Publisher/Distributor:
Address:
Price:

IV. REFERRAL OF ERIC TO COPYRIGHT/REPRODUCTION RIGHTS HOLDER:

If the right to grant this reproduction release is held by someone other than the addressee, please provide the appropriate name and address:

Name:
Address:

V. WHERE TO SEND THIS FORM:

Send this form to the following ERIC Clearinghouse:

However, if solicited by the ERIC Facility, or if making an unsolicited contribution to ERIC, return this form (and the document being contributed) to:

ERIC Processing and Reference Facility
4483-A Forbes Boulevard
Lanham, Maryland 20706

Telephone: 301-552-4200
Toll Free: 800-799-3742
FAX: 301-552-4700
e-mail: info@ericfac.piccard.csc.com
WWW: http://ericfacility.org